High-Efficiency RF Power Amplifier

NASA offers companies a revolutionary high-efficiency Class-D power amplifier that can reduce power consumption by a factor of 5.

Researchers at NASA Marshall Space Flight Center (MSFC) have developed a new power amplifier to convert direct current (DC) electrical power to a radio frequency (RF) signal. By increasing the DC-to-RF conversion efficiency, this innovation dramatically reduces power consumption, thus decreasing solar array requirements for satellites and increasing battery life for portable electronics.

Benefits

This technology offers several advantages over standard power amplifiers:

- Lower initial and operating costs
- Higher DC-to-RF conversion efficiency
- Reduced heat generation
- Lower power consumption
- Smaller size
- Longer hardware lifetime and improved reliability
- Less prone to parasitic oscillation

Commercial Applications

This power amplifier would be particularly useful for any wireless transmitter operating in the 500 MHz to 3 GHz range where power consumption is a concern:

- Uplinks and downlinks for satellites and spacecraft
- Cellular, satellite, and cordless telephones
- Mobile and fixed radio systems for land, marine, and aeronautical users
- Radionavigation and radiolocation
- Paging systems
- Wireless e-mail devices

National Aeronautics and Space Administration

The Technology

NASA Marshall Space Flight Center developed this technology to reduce the power consumed by S-band microwave power amplifiers, which typically are the largest consumers of the limited power available aboard NASA spacecraft. Prior S-band microwave amplifier biasing arrangements, such as Class-A, -B, and -C, have typical conversion efficiencies of between 10% and 20%. These efficiencies are much lower than those obtained with Class-D power amplifiers in the VLF-HF band (85% to 90%). MSFC sought to apply the lower frequency Class-D methodologies to power amplifiers that would operate at the higher S-band frequency.

In addition to extending some of the Class-D methodologies used in the VLF-HF regime to S-band frequencies, researchers also incorporated new techniques. The results were Class-D power amplifiers with a 49.7% DC-to-RF conversion efficiency at 2 to 3 GHz—a significantly higher efficiency than with prior S-band microwave power amplifiers.

This higher efficiency translates into a five-fold increase in battery life for cellular telephones, trunked communication systems, and other devices. In addition, because it is made with commercial off-the-shelf components, this invention is lower in cost than other amplifier designs. It also generates less heat than other amplifiers, is more reliable, and is less prone to parasitic oscillation. These advantages are of great value to many applications where efficiency is critical, such as satellites, cellular phones, and other portable electronics.

Partnering Opportunities

This technology is part of NASA's technology transfer program. The program seeks to stimulate development of commercial uses of NASA-developed technologies. A patent is pending on this technology, and MSFC plans to space qualify it for future missions. NASA invites commercial companies to consider licensing this technology. NASA is flexible in its agreements, and opportunities exist for exclusive, nonexclusive, and exclusive field-of-use licensing.

For More Information

If you would like more information about this technology or about NASA's technology transfer program, please contact:

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More information about working with MSFC's Technology Transfer Department is available online.

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